

Bihar Engineering University, Patna

B.Tech 2nd Semester Examination, 2025

Course: B.Tech

Code: 100201

Subject: Engineering Physics

Time: 03 Hours

Full Marks: 70

Instructions:-

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

Q.1 Choose the correct option / answer the following (Any seven question only):

[2 x 7 = 14]

- (a) For which angle of scattering is the Compton shift maximum
 - (i) 0°
 - (ii) 90°
 - (iii) 180°
 - (iv) none of the above
- (b) Which of the following is the characteristic of wave function?
 - (i) Continuous
 - (ii) Single valued
 - (iii) Normalizable
 - (iv) All of the above
- (c) Critical angle depends on
 - (i) Refractive Index of rarer medium
 - (ii) Refractive Index of denser medium
 - (iii) Refractive Index of both rarer and denser medium
 - (iv) Refractive Index of none
- (d) Diamagnetic materials are
 - (i) Weakly repelled by magnetic field
 - (ii) Strongly repelled by magnetic field
 - (iii) Weakly attracted by magnetic field
 - (iv) Strongly attracted by magnetic field
- (e) Write down time-independent Schrödinger's wave equation in 1-dimension.
- (f) Young's double slit experiment was performed in a laboratory by taking monochromatic blue, orange and red light and fringe widths were obtained as β_B , β_O , β_R respectively. Other variables had been kept constants. Write down the fringe widths in decreasing order.
- (g) Write down the Maxwell's equation which explains the non-existence of singular magnetic poles.
- (h) What is Lorentz force?
 - (i) The maximum velocity and maximum acceleration in a simple harmonic oscillator are numerically equal. What is the time period?
 - (j) What is the ratio of intensities of maxima and minima in interference if the intensity ratio is 9 : 1 ?

- Q.2** (a) Mention the forces acting in Forced Harmonic Oscillator. Set its differential equation. Derive expressions for the phase difference and resultant amplitude. [7]
- (b) What is Coriolis acceleration? Explain its applications in weather system. [7]

- Q.3** (a) Discuss the structure and working of He-Ne LASER. Draw its energy band diagram. [7]
- (b) What is population inversion? What is its importance in Lasing action? [7]

- Q.4** (a) Derive an expression for resultant intensity in Fraunhofer's single slit diffraction. Mention the conditions for maxima and minima. Draw the intensities distribution curve. [7]
- (b) Write a short note on Michelson's interferometer. [7]
- Q.5** (a) Derive an expression for torque on a magnetic dipole inside a uniform magnetic field. Define magnetic moment. [7]
- (b) What is ferromagnetic hysteresis? Draw the B-H plot and show the coercive field and remanent magnetisation in the plot. [7]
- Q.6** (a) Discuss Kronig-Penney model for the motion of an electron in a periodic potential and the existence of allowed and forbidden energy bands. [7]
- (b) Draw the total Energy (E) vs. Wave number (k) curve for an electron in 1-D lattice. [7]
- Q.7** (a) What is Compton Effect? Give the expression for Compton shift. How does the shift depend upon the angle of scattering? [7]
- (b) Derive Einstein's photo-electric equation. Plot the variation of frequency vs. stopping potential. Define threshold frequency. [7]
- Q.8** Write down Schrödinger's wave equation for a particle inside 1-D Box given by $V(x) = 0, 0 < x < L = \infty, x < 0$ and $x > L$ [14]
Solve it to obtain energy eigen values. Show that energy eigen values are discrete.
- Q.9** Write short note on *any two* of the following: [7 x 2 = 14]
- Amplitude Resonance
 - Electronic Polarization in dielectrics
 - 3-level LASER

